

NOTES ON THE HOLOTHURIOIDEA OF THE INDIAN OCEAN.

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(With three Plates.)

II.—THE SUB-GENERA ARGIODIA AND ACTINOPYGA.

IN a Paper published in this Journal* I have given reasons for combining the genera *Mülleria* and *Holothuria* under the latter name, and I divided the old genus *Mülleria* into two sub-genera, for which I proposed the names *Argiodia* and *Actinopyga*.

The material upon which the following notes are based is taken from the collections referred to in a previous Paper in this Journal.† Of the four known species of the sub-genus *Argiodia*, three have been recorded from the Indian Ocean, and all from the Indo-Pacific region. *Argiodia flavo-castanea* and *Argiodia parvula* have also been recorded from the Atlantic.

Of the eight species of *Actinopyga*, six have been recorded from the Indian Ocean, and seven from the Indo-Pacific region. Only one species, *Act. agassizi*, has not been found outside the Atlantic.

The species dealt with in the present Paper are as follows :—

Sub-genus ARGIODIA. Pearson.

Argiodia maculata (Brandt).

Argiodia flavo-castanea (Thel).

Argiodia parvula (Selenka).

* Pearson : " Proposed Re-classification of the genera *Mülleria* and *Holothuria*."—*Spolia Zeylanica*, Vol. IX., Part XXXV., pp. 163–172,

† Pearson : " Notes on the Holothuriodea of the Indian Ocean, I.—The genus *Holothuria*."—*Spolia Zeylanica*, Vol. IX., Part XXXIV., pp. 49–101, Plates V.–XIV.

Sub-genus ACTINOPYGA. Bronn.

Actinopyga serratidens, Pearson.*Actinopyga miliaris* (Quoy & Gaimard).*Actinopyga lecanora* (Jäger).*Actinopyga echinites* (Jäger).*Actinopyga mauritiana* (Quoy & Gaimard).

Genus HOLOTHURIA.

Sub-genus **Argiodia**.* Pearson.

ARGIODIA MACULATA (Brandt).

(Pl. XXVII. and Pl. XXVIII., fig. 92.)

Holothuria maculata (sub-genus *Microthele*), Brandt 1835 (4).*Mülleria nobilis*, Selenka 1867 (22) ; Semper 1868 (23) ;
Théel 1886 (26).*Mülleria maculata*, Ludwig 1881 (13), 1899 (17) ; Lampert
1885 (10) ; Sluiter 1901 (25).*Actinopyga maculata*, Bedford 1899 (2).*Actinopyga nobilis*, Fisher 1907 (5).*Mülleria hadra*, Selenka 1867 (22) ; Lampert 1885 (10) ;
Théel 1886 (26).

There are several specimens of this species at my disposal, chiefly from Ceylon, Seychelles, Red Sea, and Durban.

External Appearance.—This species is somewhat variable in colour. Generally it has an equal amount of black and light yellow, the two colours being arranged in irregular patches so as to give the animal a variegated appearance. Along each side of the body these blotches of light yellow and black alternate, and sometimes produce a striped appearance. Again, the animal may have a mottled appearance due to numerous small dark brown spots on a light yellow ground. The only specimen recorded from Ceylon was obtained by me during an inspection of the Pearl Banks in April, 1913, and it

* For definition see Pearson, *Spolia Zeylanica*, Vol. IX., Part XXXV., p. 170

has a uniform brown colour. Some specimens from Durban Museum have a similar colour.

The illustrations and descriptions of this species found in the literature of the subject do not emphasize sufficiently the appearance of the animal. This is undoubtedly due to the fact that most, if not all, previous descriptions have been made from preserved material. Undoubtedly the most characteristic feature of this species is the series of prominent lateral protuberances and the small dorsal wart-like outgrowths, and in all the preserved material at my disposal I have been able to make these out only with the greatest difficulty. In some specimens they appear to be entirely absent. Whether there is any considerable amount of variation in this respect I cannot say. In the only living specimen I have been able to examine the lateral prominences are well developed, as shown in Pl. XXVI. After this particular specimen was preserved the elevations were only imperfectly seen, and the small dorsal tubercles disappeared altogether *

A living specimen taken on the Ceylon pearl banks measured 350 mm. long and 150 mm. in greatest breadth. There were five large protuberances on each side of the body at the junction of the bivium and trivium. These elevations stood out about 16 mm. beyond the general contour of the body. On each radius of the bivium was a row of smaller tubercles, about a dozen in each row. The ambulacral appendages consisted of small papillæ irregularly scattered on the bivium and larger and more numerous pedicels on the trivium. In some specimens, obviously due to contraction, there is a clear distinction between the trivium and the rest of the body, as the ventral surface forms a distinct sole. The colour during life was uniform auburn-brown on the bivium and a slightly lighter colour below.

* Since writing the above I have obtained another specimen of this species from the Ceylon pearl banks. It had the typical yellow and black blotches referred to above, and the lateral projections were not well marked. It is probable, therefore, that the well-defined projections shown in Pl. XXVII. are not typical of the species. The figure is retained as it was drawn from life, and it may be regarded as an unusual example of the species, both as regards colour and the size of the lateral projections.

This species has from eighteen to twenty tentacles and five small anal teeth. Opposite each tooth is a group of papillæ.

The ambulacral appendages all have well-developed sucking discs, but it is highly probable that the ventral appendages alone are used in locomotion.

Internal Structure.—The calcareous ring is well developed. The radial pieces have three anterior indentations alternating with four blunt processes. The inter-radials possess a single anterior tooth. The posterior part of each radial piece is separated from the anterior part by a well-defined curved suture.

There is generally one stone canal attached to the right side of the dorsal mesentery and one large Polian vesicle.

Spicules.—The calcareous deposits consist of tables and peculiar hollow fenestrated bodies. The tables are comparatively scarce, and are masked to a great extent by the large numbers of fenestrated bodies that lie in the deeper layers of the perisome. The tables are 66 μ . in diameter and 50 μ . high. The hollow spicules are 80 μ . long.

Remarks.—According to Selenka the only difference between this species and *Argiodia hadra* (Selenka) is in the nature of the calcareous ring. In the latter form the antero-posterior axis of the radials and inter-radials is much longer in proportion than in *Argiodia maculata*. I am inclined to think that *Argiodia hadra*, apparently described by Selenka from a single specimen, should be included in the species *maculata*.

General Distribution.—Indo-Pacific region.

ARGIODIA FLAVO-CASTANEA (Théel).

(Pl. XXVIII., fig. 3.)

Mülleria flavo-castanea, Théel 1886 (26).

One specimen from Munich, found in the Red Sea.

External Characters.—The specimen under examination is much larger than Théel's specimen and is different in colour, but otherwise agrees with Théel's description. It is 280 mm.

long in the contracted condition, and is light yellow in colour. The pedicels on the trivium are crowded together and form a kind of sole, as described by Théel. The dorsal papillæ are not so numerous or so large. There are slight elevations at each side of the body, which may be due to the contraction of the specimen, or they may be similar projections to those described in *Argiodia maculata*. There are twenty tentacles.

Internal Structure.—The calcareous ring is similar to that of *Argiodia maculata*. There is one large Polian vesicle, but no stone canal can be seen. Théel records the presence of a single stone canal. There are no Cuvierian organs present, although they were present in Théel's type specimen.

Spicules.—These consist of tables and knobbed buttons. The tables are $55\ \mu$ in diameter and about the same height. The buttons, which are about $80\ \mu$ long, have four or five pairs of holes, and in the centre bear three or four knobs.

General Distribution.—Madeira, Red Sea. A rare form, with a curious distribution.

Remarks.—Only in one respect does this species differ from *A. maculata*, and that is in the nature of the buttons. Apart from this character the two species appear to be identical. I cannot admit with Théel and Bedford the possibility of this species being identical with *A. parvula*, as the buttons are different, and the calcareous rings of the two species are dissimilar.

ARGIODIA PARVULA (Selenka).

(Pl. XXVIII., fig. 4.)

Mülleria parvula, Selenka 1867 (22); Lampert 1885 (10);
Théel 1886 (26).

Actinopyga parvula, Bedford 1898 (1); Fisher 1907 (5).

There are several specimens from Prof. Gardiner's Maldivé collection and one specimen from the Dublin Museum obtained from the Seychelles.

External Characters.—This appears to be a very small species, and I cannot find any record of a specimen over 50 mm. in length. The largest specimen I have examined is only

40 mm., and several of them are only 25 mm. Thus, this species is very different from other species of the genus, the members of which are usually characterized by a large size. The small size of the specimens makes it difficult to determine the characters. The colour is generally dark brown, but the Seychelles specimen is light yellow. The ventral pedicels are crowded and are of comparatively large size. The dorsal papillæ are apparently much smaller and less numerous. There are twenty tentacles, and the anus is surrounded by five minute teeth.

Internal Structure.—The calcareous ring agrees with Fisher's figure more than with Selenka's. The two anterior lateral notches of the radial pieces figured by Selenka are not present in any of the specimens I have examined. The small size of the specimens has not permitted the stone canal and Polian vesicles to be clearly made out. Selenka describes one of each, and Fisher makes out two Polian vesicles and one stone canal. Cuvierian organs are present, according to Fisher.

Spicules.—These consist of tables and smooth buttons, and closely resemble the deposits of *Halodeima difficilis*, and probably explain why Haacke (according to Ludwig) mistook some specimens of the latter species for the species under discussion. The tables are pierced with about eight peripheral holes, which alternate with an equal number of smaller holes. The base is 70 μ in diameter, and the tower, which bears a spinous top, is about 55 μ in height. The buttons are oval and smooth, and are irregularly pierced by about three pairs of holes. These buttons are about 85 μ in length.

Remarks.—This species is distinguished from *Argiodia flavo-castanea* by (a) its size ; (b) the shape of the calcareous ring, although this character is apparently variable ; and (c) the nature of the buttons. So far as our small knowledge of the two forms goes, there is no reason to believe they are identical, as Théel and Bedford have suggested.

General Distribution.—The distribution of this species is interesting, and includes Florida, Seychelles, Maldives, Hawaii, and Funafuti.

Sub-genus **Actinopyga**.^{*} Bronn.

ACTINOPYGA SERRATIDENS. Pearson.

(Pl. XXIX., fig. 5.)

Actinopyga serratidens, Pearson 1903 (18).

This species was named and described by the present writer in 1903 from a single specimen obtained by Professor Herdman from Galle, Ceylon. Since then it has not been recorded. Amongst the Holothurians collected by Mr. Crossland at Suakin in the Red Sea, and sent to me by Prof. Stanley Gardiner, are several specimens of this species. During a two months' inspection cruise on the Ceylon pearl banks early in 1913, I found this species extraordinarily abundant. With the exception of *Halodeima atra*, which appears to be the predominant Holothurian along the Ceylon coast, and *Bohadschia marmorata* and *Thymiosicya scabra*, which are abundant though limited in their distribution, I consider the above species the commonest form in the littoral waters of Ceylon. It is also one of the largest Holothurians I have seen, and frequently attains a size of 400 mm.

External Appearance.—Without exception the Ceylon specimens are uniformly black, with a faint suggestion of dark brown. All the Red Sea specimens, except one, on the other hand, are black above and yellowish-white below, and at first sight resemble *Actinopyga mauritiana*. The single exception is similar to the Ceylon specimens in colour. Out of more than one hundred specimens from Ceylon waters, all from the pearl banks, I have not seen one which has any trace of light colour about it, with the exception of the pedicels, which are sometimes white. The ambulacral appendages consist of numerous pedicels evenly distributed over the trivium, and small papillæ scattered over the bivium and less abundant than the pedicels. There are twenty dark brown tentacles.

The anal teeth are large and yellow and irregular in shape, producing the serrated appearance referred to in my original

^{*}For definition see Pearson, *Spoilia Zeylanica*, Vol. IX., Part XXXV., p. 169.

description of the species. This is not the only species of *Mülleria* that has irregularly formed teeth. I have found that in most species, particularly in *A. echinites*, individuals may occasionally have serrated teeth. The only specimen of *A. agassizi* that I have examined has teeth very similar to those of *A. serratidens*, but I cannot say whether this is a regular character. In *A. serratidens* all the specimens I have had occasion to examine have irregular teeth.

The ventral pedicels are not arranged in series, but are evenly scattered over the trivium. Frequently they are white. The papillæ are invariably black, and are scattered over the bivium without definite arrangement. They are smaller and less numerous than the pedicels. There are twenty dark brown tentacles.

Internal Structure.—The calcareous ring is similar to that in most species of the sub-genus. There is one Polian vesicle. In the type specimen described by me in 1903 there were eight stone canals. In most of the Ceylon specimens recently examined, the stone canal was single and was attached to the right side of the dorsal mesentery.

In a few cases I have observed from sixty to a hundred small bodies evenly distributed on both sides of the dorsal mesentery on a level with the Polian vesicle. These bodies are extremely small, and the short stalk ends in a white globular head .6 mm. in diameter. These problematic bodies are similar in position and appearance to those described by Selenka (22) in *Actinopyga mauritiana* (*Mülleria varians*).

No other points in the internal structure call for special comment, the respiratory trees and the Cuvierian organs being typical.

Spicules.—The spicules in the Ceylon specimens are similar to those described by me from the type species. Usually, owing to the dark pigment, the spicules are hard to see. In the specimens from the Red Sea the spicules are much more abundant, particularly in the ventral perisome, where, owing to the absence of pigment and to their being very closely packed, their presence is very readily detected.

General Distribution.—Ceylon, Red Sea, Maldives.

ACTINOPYGA MILIARIS (Quoy & Gaimard).

(Pl. XXIX., fig. 6.)

Holothuria miliaris, Quoy & Gaimard 1833.*Holothuria lineolata*, Quoy & Gaimard 1833 (21).*Mülleria miliaris*, Brandt 1835 (4); Selenka 1867 (22); Ludwig 1882 (14), 1887 (15), 1888 (16), 1899 (17); Lampert 1885 (10); Théel 1886 (26); Bell 1887 (3); Sluiter 1901 (25); Koehler & Vaney 1908 (9); Pearson 1910 (19).*Mülleria lineolata*, Brandt 1835 (4).*Mülleria plebeja*, Selenka 1867 (22).

External Characters.—This species attains a size of about 200 mm. It is generally coloured a uniform dark brown. Rarely is the ventral surface lighter than the dorsal. There are twenty tentacles.

Internal Structure.—Internally there appears to be no difference from the arrangement seen in *Actinopyga lecanora*. In one specimen examined there were two well-developed Polian vesicles and one stone canal. The calcareous ring is of the usual type seen in this genus.

Spicules.—These consist of numerous minute "rosettes," which are dichotomously branched, and which are about 32 μ in length.

Remarks.—Selenka examined Quoy & Gaimard's original specimens in Paris, and we have to accept his assurance that *Holothuria miliaris*, Q. & G., *Holothuria lineolata*, Q. & G., and *Mülleria plebeja*, Selenka, are all identical. It is fortunate that Quoy & Gaimard's specimens were preserved, since the original descriptions were insufficient for the purposes of identification. This to some degree may be said to apply to Selenka's description of *Mülleria plebeja*. Why Selenka and subsequent writers did not retain the name *lineolata* is not quite clear, since it appears before *miliaris* in the original description and therefore takes precedence. The name

lineolata, though correct, has not been used since 1835, and, therefore, on the grounds of convenience, I propose retaining the name *miliaris*. With reference to the relationship between *Actinopyga miliaris* and *Actinopyga lecanora*, see my remarks under the latter species.

General Distribution.—Indian Ocean, East Indies.

ACTINOPYGA LECANORA (Jäger).

(Pl. XXIX., fig. 9.)

Mülleria lecanora, Jäger 1833 (7); Selenka 1867 (22); Semper 1868 (23); Ludwig 1881 (13), 1882 (14), 1887 (15); Lampert 1885 (10); Théel 1886 (26); Sluiter 1887 (24), 1901 (25); Vaney 1905 (27); Koehler & Vaney 1908 (9); Pearson 1910 (19).

Holothuria dubia (sub-genus *Microthele*), Brandt 1835 (4).

Actinopyga lecanora, Bedford 1899 (2).

External Characters.—This species attains a length of upwards of 200 mm. It is chocolate-brown above with light yellow mottlings and is light yellow below. There is a light area around the anus. The dorsal papillæ are scattered, and are smaller than the ventral pedicels. The latter show a distinct arrangement into three broad rows, although there are pedicels scattered on the interambulacra. There are twenty dark tentacles.

Internal Structure.—The calcareous ring is similar in general appearance to the common type of the sub-genus. There is a single Polian vesicle and a single stone canal on the right side of the dorsal mesentery.

Spicules.—These are similar to the deposits of *Actinopyga miliaris* in both shape and size, but differ in being arranged in groups.

Remarks.—There appears to be very little difference between this species and *Actinopyga miliaris*. The only two points of difference are in the colour and the deposits. *A. miliaris* has a uniformly-coloured body, generally a dark

brown. *A. lecanora*, on the other hand, is lighter on the trivium and has a light patch around the anus. The spicules of both forms are exactly alike, but in *A. lecanora* they are stated by most writers to be arranged in little groups. I have not had access to a large series of these two species, so that I am not in a position to give an opinion on the value of these two distinguishing characters. Perhaps the most striking is the light circular area around the anus, and this would appear to be constant. In a Japanese specimen of *A. lecanora* I have been unable to satisfy myself that there is any distinct arrangement of the spicules into groups. Any investigator who has the opportunity of examining a large series of these two forms would do well to go into the question of colour and spicular differences.

General Distribution.—Indo-Pacific.

ACTINOPYGA ECHINITES (Jäger).

(Pl. XXIX., fig. 7.)

Mülleria echinites, Jäger 1833 (7); Selenka 1867 (22); Semper 1868 (23); Ludwig 1882 (14), 1887 (15), 1899 (17); Lampert 1885 (10), 1895 (12); Théel 1886 (26); Whitelegge 1897 (28), 1903 (29); Sluiter 1901 (25); Pearson 1910 (20).

Actinopyga echinites, Bedford 1898 (1).

A fairly common form in the Indo-Pacific region. It is well represented in most of the collections at my disposal.

External Characters.—A large robust form frequently attaining a size of over 250 mm., though generally less than this in preserved specimens. The body is much stouter in the middle than in most Holothurians, and the greatest width may be nearly half the total length. The body is slightly curved and becomes narrower at each end. The mouth is ventral and is surrounded by a distinct rim formed of papillæ. The anus is slightly dorsal and is surrounded by five teeth, which often have an irregular surface. There are twenty dark brown

tentacles. In the living specimen the bivium is generally slightly wrinkled, and these grooves are much more accentuated in spirit specimens.

The ambulacral appendages are pedicels on the trivium and papillæ on the bivium. The pedicels are arranged in three broad rows with a few on the interambulacra.

The papillæ on the bivium are fairly large and are evenly scattered. Théel's statement that there are true pedicels on the bivium does not appear to be correct, since in the living specimen none of the dorsal appendages have the suctorial qualities of true pedicels. In no case have I found that the dorsal appendages have the qualities of true pedicels, although they may have a sucking disc strengthened by a perforated plate.

Internal Structure.—The calcareous ring is similar to that of *Act. miliaris*, but is slightly variable. Usually there is a single large stone canal attached to the right side of the dorsal mesentery, and there is one large Polian vesicle.

Spicules.—These consist of richly branched rods having a length of 80 μ and smaller dichotomously branched rosettes similar to those of *Act. miliaris*, except that the branching is richer. These are about 30 μ in length. There are also larger irregular rods in the pedicels and papillæ having a length of 130 μ .

Remarks.—This species is undoubtedly related to *Act. miliaris*, but the deposits are always larger and more richly branched. A specimen from Prof. Stanley Gardiner's collection has given me some trouble owing to the nature of the spicules. The specimen is full-sized and is light yellow in colour, and has all the characters associated with *Act. echinites*, except the anal teeth, which are large and serrated like those of *Act. serratidens*. The spicules are abundant, but different from those of any known species. I have come to the conclusion that it is a specimen of *Act. echinites* in which the spicules have been partly dissolved, probably owing to the action of formalin.

General Distribution.—Indo-Pacific.

ACTINOPYGA MAURITIANA (Quoy & Gaimard).

(Pl. XXIX., fig. 8.)

Holothuria mauritiana, Quoy & Gaimard 1833 (21).*Mülleria mauritiana*, Selenka 1868 ; Ludwig 1882 (14), 1887 (15), 1888 (16), 1899 (17) ; Lampert 1885 (10), 1889 (11) ; Théel 1886 (26) ; Sluiter 1887 (24), 1901 (25) ; Koehler & Vaney 1908 (9) ; Pearson 1910 (29).*Mülleria varians*, Selenka 1867 (22).*Actinopyga mauritiana*, Bell 1887 (3) ; Bedford 1898 (1), 1899 (2) ; Pearson 1903 (18) ; Fisher 1907 (5).

This species is represented in most of the collections under examination. It is universally distributed throughout the Indo-Pacific, and is perhaps the commonest species of *Actinopyga*.

External Appearance.—This species is subject to much variation in colour. The commonest type is coloured chocolate-brown on the bivium and yellowish-white on the trivium, the two being distinctly separated, so that the white trivium forms a kind of sole. Sometimes the papillæ in the bivium are surrounded by yellowish-white rings. Occasionally these rings coalesce to form irregular patches. In several specimens I have examined there is no clear separation of colour of the lighter trivium from the darker bivium, the transition from the one to the other being gradual. In a few instances there is very little brown on the bivium owing to the yellow rings around the papillæ being extremely numerous. In fact, every stage of colour is represented between the two extremes, on the one hand the form in which the limits of the brown bivium and yellowish-white trivium are very clearly defined, and on the other the form in which brown is mottled on a yellow ground, both on the dorsal and ventral surfaces. There are usually twenty-five tentacles present. The five anal teeth are smooth and are of medium size. This species grows to a length of over 400 mm.

The ambulacral appendages consist of papillæ on the bivium and true pedicels on the trivium. The latter are more closely

arranged than the former and are evenly scattered over the ventral surface without showing, as a rule, any disposition into rows. In a young specimen about 100 mm. long, however, I have discerned three rows of tube feet, each row being about eight pedicels wide.

Internal Structure.—The calcareous ring differs but little from the usual type seen in this genus. The radials have three anterior concavities, the middle one being shallower than the two lateral ones. The inter-radial piece has a single anterior tooth.

This species has a variable number of stone canals. In various specimens I have counted from six to twenty, equally disposed on both sides of the dorsal mesentery. The stone canals generally have a twisted stalk and a swollen end, and sometimes they are branched. Selenka (22) in his account mentions the presence of a “knopfförmig” stone canal and then proceeds to mention the presence of “eine anzahl von kleinen mit elliptischen körnern prall gefüllten Bläschen.” Whether these bodies are really stone canals as their position in his figure would suggest, and whether they are similar to the bodies described by me from *Actinopyga serratidens*, I cannot say. The number of Polian vesicles is also variable. In the specimen with twenty stone canals there were three long narrow Polian vesicles 30 mm. long in the contracted condition. Frequently only one vesicle is present.

Spicules.—The deposits are very characteristic, and are of two distinct kinds. Those on the bivium are either small dichotomously branching “rosettes” 50 μ long, or longer spinous rods 80 μ in length. The deposits of the ventral surface consist entirely of oval grains 22 μ in diameter.

General Remarks.—There appears to be some reason for Théel's suggestion that *Actinopyga agassizi* is probably a variety of the above species. The two, however, differ with regard to the spicules of the bivium. In *A. agassizi* they consist of small X-shaped bodies, which are not so numerous as the characteristic spiny rods of *A. mauritiana*. The calcareous rings are similar, and in both cases there are about twenty-five tentacles. In a specimen of *A. agassizi* examined by me, the body had a uniform colour of chocolate-brown with

one or two small yellow patches on the dorsal surface. The pedicels were light yellow in colour and were scattered all over the trivium, though much more numerous in the radii. So far as I can ascertain *A. mauritiana* is solely confined to the Indo-Pacific, while *A. agassizi* has been found in the Atlantic, but never in the Pacific. There are, however, many instances of Pacific forms being found in the Caribbean Sea, *Argiodia parvula* being a case in point. *Actinopyga mauritiana* is very constant with regard to its spicules, and I have never examined a specimen in which the dorsal spicules resembled those of *A. agassizi* figured by Selenka. The single specimen of *A. agassizi* examined by me agrees with Selenka's description in this respect. There would appear to be a constant difference in the spicules of the two forms. It will be more convenient and reasonable to regard them as distinct, though undoubtedly closely related.

General Distribution.—Indo-Pacific.

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EXPLANATION OF PLATES.

Plate XXVII.

Argiodia maculata (Brandt).—View from the dorsal surface. $\times \frac{1}{2}$.
(Drawn from life.)

Plate XXVIII.

Argiodia maculata (Brandt).

Fig. 2a.—View of table from below. $\times 650$.

Fig. 2b.—Hollow fenestrated buttons. $\times 475$.

Fig. 2c.—Side view of table. $\times 650$.

Fig. 2d.—Calcareous ring. $\times 2\frac{1}{2}$.

Argiodia flavo-castanea (Théel).

Fig. 3a.—Knobbed button. $\times 500$.

Fig. 3b.—View of table from below. $\times 550$.

Fig. 3c.—Side view of table. $\times 550$.

Fig. 3d.—Calcareous ring. $\times 1\frac{3}{4}$.

Argiodia parvula (Selenka).

Fig. 4a.—View of table from below. $\times 570$.

Fig. 4b.—Side view of table. $\times 570$.

Fig. 4c.—Button. $\times 520$.

Fig. 4d.—Calcareous ring. $\times 4$.

Plate XXIX.

Actinopyga serratidens, Pearson.

Fig. 5a.—Calcareous ring. $\times 2\frac{1}{2}$.

Fig. 5b.—“ Bone-shaped ” spicules. $\times 750$.

Fig. 5c.—Commonest type of spicules. $\times 750$.

Actinopyga miliaris (Quoy & Gaimard).

Fig. 6a. }
Fig. 6b. } Spicules. $\times 625$.

Fig. 6c.—Calcareous ring. $\times 3$.

Actinopyga echinites (Jäger).

Fig. 7a.—Calcareous ring. $\times 1\frac{3}{4}$.

Fig. 7b. }
Fig. 7c. } Spicules from the general integument. $\times 475$.

Fig. 7d.—Spicules from pedicels. $\times 385$.

Actinopyga mauritiana (Quoy & Gaimard).

Fig. 8a.—Spinous rod from dorsal integument. $\times 650$.

Fig. 8b.—Rod from ventral integument. $\times 680$.

Fig. 8c.—“ Rosette ” from dorsal integument. $\times 570$.

Fig. 8d.—“ Grains ” from the ventral integument. $\times 500$.

Fig. 8e.—Calcareous ring. $\times 1\frac{3}{4}$.

Actinopyga lecanora (Jäger).

Fig. 9.—Calcareous ring. $\times 2\frac{1}{2}$.